CLAIMS

What is claimed is.

1. A process of making a storage device comprising:

forming a first electrode on a substrate;

forming a ferroelectric polymer structure over the substrate;

forming an upper protective film over the ferroelectric polymer structure; and

forming a second electrode on the second protective film.

2. The process according to claim 1, wherein the upper protective film is a second protective film, and further comprising:

forming a first protective film on the first electrode.

3. The process according to claim 2, wherein forming a first protective film on the first electrode further comprises:

forming a self-aligned first protective film over the first electrode.

4. The process according to claim 2, wherein forming a first protective film on the first electrode, further comprises:

forming a damascene structure in the substrate from the first electrode and the first protective film by a process selected from mechanical polishing, chemical-mechanical polishing, chemical etchback, and combinations thereof.

5. The process according to claim 2, wherein the first protective film and the second protective film are formed by atomic layer chemical vapor deposition of materials selected from metals, refractory metals, their alloys, their nitrides, oxides, and carbides, and combinations thereof.

6. The process according to claim 1, wherein forming a ferroelectric polymer structure further comprises:

forming a first ferroelectric polymer layer over the substrate;

forming a spin-on ferroelectric polymer layer over the first ferroelectric polymer layer; and

forming a second ferroelectric polymer layer over the spin-on ferroelectric polymer layer.

7. The process according to claim 1, wherein forming a ferroelectric polymer structure further comprises:

Langmuir-Blodgett depositing a first crystalline ferroelectric polymer layer over the substrate;

forming a spin-on ferroelectric polymer layer over the first ferroelectric polymer layer, wherein the spin-on ferroelectric polymer layer is selected from polyvinyl and polyethylene fluorides, polyvinyl and polyethylene chlorides, polyacrylonitriles, polyamides, copolymers thereof, and combinations thereof;

Langmuir-Blodgett depositing a second crystalline ferroelectric polymer layer over the spin-on polymer layer; and

wherein the first and second crystalline ferroelectric polymer layers are selected from polyvinyl and polyethylene fluorides, polyvinyl and polyethylene chlorides, polyacrylonitriles, polyamides, copolymers thereof, and combinations thereof.

8. The process according to claim 2, wherein forming the first and second protective films are accomplished by atomic layer chemical vapor deposition of a composition selected from titanium metal, titanium metal alloys, at least one titanium nitride, at least one titanium carbide, at least one titanium oxide, and combinations thereof.

9. The process according to claim 1, wherein forming a first electrode is carried out by chemical vapor deposition, and forming a second electrode is carried out by physical vapor deposition.

10. The process according to claim 1, wherein forming a ferroelectric polymer structure over the substrate further comprises:

Langmuir-Blodgett depositing a single, crystalline ferroelectric polymer layer over the substrate.

11. A memory article comprising:

a first electrode disposed on a substrate;

a ferroelectric polymer structure disposed over the substrate and the first protective film;

an upper protective film disposed over the ferroelectric polymer structure; and

a second electrode disposed above and on the second protective film.

12. The memory article according to claim 11, wherein the upper protective film is a second protective film, and further comprising:

a first protective film disposed on the first electrode.

13. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises:

a first crystalline ferroelectric polymer layer disposed over the substrate;

a spin-on ferroelectric polymer layer disposed over the first crystalline ferroelectric polymer layer; and

a second crystalline ferroelectric polymer layer disposed over the spin-on polymer layer.

14. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises:

a first crystalline ferroelectric polymer layer disposed over the substrate, wherein the first crystalline ferroelectric polymer layer has a thickness in a range from about 5 Å to about 45 Å;

a spin-on ferroelectric polymer layer disposed over the first crystalline ferroelectric polymer layer, wherein the spin-on ferroelectric polymer layer has a thickness in a range from about 500 Å to about 2,000 Å; and

a second crystalline ferroelectric polymer layer disposed over the spin-on polymer layer, wherein the second crystalline ferroelectric polymer layer has a thickness in a range from about 5 Å to about 45 Å.

15. The memory article according to claim 13, wherein the spin-on ferroelectric polymer layer and the crystalline ferroelectric polymer layers are made of the same composition.

16. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises:

a first crystalline ferroelectric polymer layer disposed over the substrate;

a spin-on polymer layer disposed over the first crystalline ferroelectric polymer layer;

a second crystalline ferroelectric polymer layer disposed over the spin-on polymer layer; and

wherein crystallinity of the first and second crystalline ferroelectric polymer layers is in a range from about one-third to greater than about one-half.

17. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises:

a single, crystalline ferroelectric polymer layer disposed over the substrate, wherein the single, crystalline ferroelectric polymer layer has a thickness in a range from about 100 Å to about 2,000 Å.

18. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises a polymer selected from polyvinyl and polyethylene fluorides, polyvinyl and polyethylene chlorides, polyacrylonitriles, polyamides, copolymers thereof, and combinations thereof.

19. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises a polymer selected from $(CH_2\text{-}CF_2)_n$, $(CHF\text{-}CF_2)_n$, $(CF_2\text{-}CF_2)_n$, α-, β-, γ-, and δ-phases thereof, $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, α-, β-, γ-, and δ-phases of $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, and combinations thereof.

20. The memory article according to claim 11, wherein the ferroelectric polymer structure further comprises a copolymer selected from β-phase $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, wherein n and m equal 1, and wherein n is in a fraction range from about 0.6 to about 0.9.

21. A cross-point matrix polymer memory structure comprising:

a first aluminum or copper electrode disposed on a substrate;

a first refractory metal nitride or oxide protective film disposed above and on the first electrode;

a ferroelectric polymer structure disposed over the substrate and the first protective film;

a second refractory metal nitride or oxide protective film disposed over the ferroelectric polymer structure; and

a second aluminum or copper electrode disposed above and on the second refractory metal nitride protective film.

22. The cross-point matrix polymer memory structure according to claim 21, wherein the ferroelectric polymer structure further comprises:

a first crystalline ferroelectric polymer layer disposed over the substrate, wherein the first crystalline ferroelectric polymer layer has a thickness in a range from about 5 Å to about 45 Å;

a spin-on ferroelectric polymer layer disposed over the first crystalline ferroelectric polymer layer, wherein the spin-on ferroelectric polymer layer has a thickness in a range from about 500 Å to about 2,000 Å;

a second crystalline ferroelectric polymer layer disposed over the spin-on polymer layer, wherein the second crystalline ferroelectric polymer layer has a thickness in a range from about 5 Å to about 45 Å; and

wherein crystallinity of the first and second crystalline ferroelectric polymer layers is in a range from about one-third to greater than about one-half.

23. The cross-point matrix polymer memory structure according to claim 21, wherein the ferroelectric polymer structure further comprises:

a crystalline ferroelectric polymer layer disposed above and on the first refractory metal nitride or oxide protective film, and below and on the second refractory metal nitride or oxide protective film, wherein the crystalline ferroelectric polymer layer has a thickness in a range from about 100 Å to about 2,000 Å; and

wherein the second refractory metal nitride or oxide protective film is disposed above and on the crystalline ferroelectric polymer layer.

24. The cross-point matrix polymer memory structure according to claim 21, wherein the ferroelectric polymer structure further comprises a polymer selected from $(CH_2\text{-}CF_2)_n$, $(CHF\text{-}CF_2)_n$, $(CF_2\text{-}CF_2)_n$, α-, β-, γ-, and δ-phases thereof, $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, α-, β-, γ-, and δ-phases of $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, and combinations thereof.

25. The cross-point matrix polymer memory structure according to claim 21, wherein the ferroelectric polymer structure further comprises a copolymer selected from α-, β-, γ-, and δ-phases of $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, wherein n and m equal 1, and wherein n is in a fraction range from about 0.6 to about 0.9.

26. The cross-point matrix polymer memory structure according to claim 21, wherein the ferroelectric polymer structure further comprises β-phase $(CH_2\text{-}CF_2)_n$ in $(CH_2\text{-}CF_2)_n\text{-}(CHF\text{-}CF_2)_m$ copolymer, wherein n and m equal 1, and wherein n is in a fraction range from about 0.7 to about 0.8.

27. A memory system comprising:

a substrate disposed on a physical interface for a host;

a memory article disposed on the substrate, the memory article comprising:

a first electrode disposed on a substrate;

a first protective film disposed above and on the first electrode;

an FEP structure disposed over the substrate and the first protective film;

a second protective film disposed over the FEP structure; and

a second electrode disposed above and on the second protective film;

a signal interface for communication from the memory article to the host; and

a host.

28. The memory system according to claim 27, wherein the physical interface is configured to a host interface that is selected from a PCMCIA card interface, a compact flash card interface, a memory stick-type card interface, a desktop personal computer expansion slot interface, and a removable medium interface.

29. The memory system according to claim 27, wherein the ferroelectric polymer structure comprises:

a first crystalline ferroelectric polymer layer disposed over the substrate;

a spin-on ferroelectric polymer layer disposed over the first crystalline ferroelectric polymer layer; and

a second crystalline ferroelectric polymer layer disposed over the spin-on polymer layer.